

Remarks

In view of the following remarks, favorable reconsideration of the outstanding office action is respectfully requested. Claims 1 – 55 remain in this application.

**1. Prolonged Prosecution – Fifth (5<sup>th</sup>) Office Action**

Applicants respectfully note that this is the fifth Office Action issued by the Examiner since this case was filed. Applicants also note that the Examiner appears to be recycling the references. In the last Office Action (7/15/04) the Examiner asserted the *Heller* reference against the claimed invention. In the one before that (1/23/04) the Examiner asserted the *Russell* reference against the claimed invention. Now, the Examiner asserts both *Heller* and *Russell*, in addition to other references previously considered, against the claimed invention. As a matter of fairness, this case should be allowed and passed on to issuance.

The MPEP states that “...*the shortest path to the final disposition of an application is by finding the best references on the first search and carefully applying them.*” See MPEP 707.02. In this case, the Applicants respectfully assert that the Examiner has done that, but for some reason refuses to pass the case on to issue.

The Applicants again respectfully point out that it is neither fair nor equitable for the Patent Office to endlessly churn the same references over and over again in different combinations. The Applicants have refuted the prior rejections because the references simply do not teach or suggest the claimed subject matter.

The Applicants thank the Examiner in advance for his consideration in this matter.

**2. Allowed Claims/Subject Matter**

Applicant notes with appreciation that the Examiner has indicated the subject matter of claims 15 – 23, 26 – 30, 39, 40, 44, and 46 – 55 are patentable, and would be allowable if rewritten in independent form.

**3. § 103 Rejections**

A. The Examiner has rejected claims 1, 3 – 5, and 7 under 35 U.S.C. § 103(b) as being obvious over U.S. Patent No. 5,659,453 to Russell et al. (Russell) in view of U.S. Patent No. 4,325,098 to Heller.

Claim 1 is directed to an arc fault detector for a power line system. The detector includes an upstream/downstream discriminator circuit. The discriminator circuit detects current fluctuations in at least one current characteristic of a load current and voltage fluctuations in at least one voltage characteristic of a line voltage. The discriminator circuit detects an upstream transient event when the current fluctuations and the voltage fluctuations are in phase. The discriminator circuit detects a downstream transient event when said current fluctuations and said voltage fluctuations are out of phase.

Russell is directed to a method and apparatus for detecting an arcing fault on a power feeder line 12. Feeder line 12, which may deliver power over three phase lines, known as phases A, B, and C, which are 120 degrees apart in phase. See Col. 3, lines 40 – 47. Russell determines an “X-indicator” for each phase line (A, B, or C). The X-indicator for each phase line ( $X_A$ ,  $X_B$ , and  $X_C$ ) is determined by calculating the numerical correlation to a model function stored within model function portion 104. The model function may be stored as a current ( $I_F$ ) which may be determined empirically, or be simulated, or determined mathematically using known analyses. See Col. 7, lines 31 – 60. Russell determines which phase line has faulted by determining which X-indicator has the greatest absolute value. The direction of the fault is determined by the sign of the X-indicator. For example, if  $X_A > 0$ , then the fault is forward. See col. 8, lines 40 – 54.

Heller is directed to a system for detecting the position of a fault on an electric link. Referring to Figure 4, the system includes a directional relays  $D_1$  and  $D_2$  that are placed at each end of a line (L) to provide a directional indication. The protective relay  $D_1$  is connected to monitor the line (L) in the direction indicated by the pointer (flag), which is referred to as the forward direction. The backward direction corresponds to that part of the electric link located outside line (L). The forward and backward direction of relay  $D_2$  is determined in the same fashion. Col. 2, line 58 – Col. 3, line 15. Protection unit  $D_1$  sends to protection unit  $D_2$

a blocking signal when it “sees” a fault in the backward direction; when it sees the fault in the forward direction, it provides no signal. Col. 3, lines 39 – 42. The “working principle of directional relays is based on the local phase comparison of voltage and current magnitudes measured at one point on the line. It is the result of this comparison which provides the forward/backward indication eventually transmitted to the other end of the line.” Col. 3, lines 62 – 67.

“The phase of a voltage existing at the measurement point before the fault occurs (*memorized voltage*) is compared with the phase of the current measured at the measurement point where the relay is located after the fault occurs. This phase comparison is conveniently expressed in terms of the ratio of complex quantities representing the voltage and the current in question. When this ratio is positive, it indicates a phase concordance between the terms of the ratio, which corresponds to a fault forward of the measurement point. In the opposite case (negative ratio, phase discordance) the fault is in the backward direction.” Col. 4, lines 1 – 13.

According to the **MPEP 2143**, three basic criteria must be met to establish a *prima facie* case of obviousness. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant’s disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

*A.1. The Prior art references do not teach or suggest all of the claim limitations*

Claim 1 is directed to an arc fault detector. The Background of the Invention refers to AFCIs used in branch circuits. Those skilled in the art understand that a branch circuit is disposed after the circuit breaker panel in a residential or commercial building. Russell, on the other hand, is directed to a computerized arc burst pattern analyzer disposed in a Power Utility Substation. See Figure 1 and col. 2, lines 20 – 23. As noted in the last response filed by the Applicants, the Examiner does not point out where Heller teaches or discloses

detecting arc faults. Col 1, lines 40 – 45 identifies faults as being due to “short circuits.” Again, as noted in a previous response, an electronic search of the patent document reveals that the term “arc fault” is not present in Heller. Applicants also noted that the Examiner failed to point out where Heller teaches or discloses an upstream/downstream discriminator circuit disposed within an arc fault detector. Accordingly, neither reference is directed to an arc fault detector, as recited in claim 1.

The Examiner asserts that Russell discloses (col. 4, lines 1 – 5) *“a power line circuit which detects load current fluctuations in a load current and line fluctuations in a line voltage.”* This is not true. The cited text merely states that transducer 30 monitors the load current and the phase voltages. The cited text says nothing about detecting fluctuations in at least one load current characteristic and voltage fluctuations in at least one voltage characteristic of a line voltage, as recited in claim 1. The Examiner also asserts that Russell teaches a power line circuit that detects *“upstream or downstream transient events...the direction of the transient event/arc fault relative to a monitoring location of a system.”* However, applicants note that the cited text (col. 2, lines 38 – 47) contradicts the Examiner’s assertions relative to col. 4, lines 1- 5 because the text in col. 2 refers to making a determination based on an “X-indicator.” As noted above, the X-indicator for each phase line ( $X_A$ ,  $X_B$ , and  $X_C$ ) is determined by calculating the numerical correlation to a model function stored within model function portion 104. See Col. 7, lines 31 – 60. Accordingly, Russell does not disclose a discriminator circuit for an arc fault detector as recited in claim 1.

The Examiner asserts that Heller discloses a “power line circuit” that detects upstream transients when current fluctuations and voltage fluctuations are in-phase and downstream transients when the current fluctuations and voltage fluctuations are out of phase. The Examiner relies on Heller, col. 3, lines 62 – 68. However, the cited text states that the “working principle of directional relays is based on the local phase comparison of voltage and current magnitudes measured at one point on the line. It is the result of this comparison which provides the forward/backward indication.” Applicants make the following points in response. First, Heller only teaches the use of a memorized voltage, i.e., a voltage measured before the occurrence of the fault condition. See col. 4, lines 1 – 25. Second, the Examiner

fails to show where Heller teaches a comparison of line voltage to load current. Thus, the Examiner does not show where Heller teaches or suggests the subject matter of claim 1.

Accordingly, the Applicants respectfully point out that neither Russell nor Heller, whether taken alone or in combination, teach or suggest a arc fault discrimination circuit that compares current fluctuations in at least one current characteristic of *a load current* and voltage fluctuations in at least one voltage characteristic of *a line voltage*. In contrast, Heller teaches a relay that compares voltage and current magnitudes at the same point on a line. The system also requires two relays to be employed at either end of the line to localize a fault condition rather than one device as recited in claim 1.

A.2. There is No Suggestion to Combine the Prior Art References

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). In this case, Russell is directed to a system disposed at a power utility substation that monitors power being provided to a feeder line. Heller is directed to detecting a fault location on a link having two parallel lines, with each line including a compensating capacitor in series between its ends. Using Heller in combination with Russell would require that a compensating capacitor be inserted in each utility feeder line being monitored by Russell. The addition of a capacitor is not only beyond the scope of Russell, but would also change the electrical characteristics of the feeder lines.

The Examiner has not made a prima facie case of obviousness for the above stated reasons. While claims 3, 4, 5, and 7 are patentable in their own right, these claims are also patentable by virtue of their dependency from claim 1. Accordingly, claim 1 is patentable under 35 U.S.C. § 103(a). The Applicants respectfully request that the rejection of claim 1 under 35 U.S.C. § 103(a) be withdrawn.

B. The Examiner has rejected claims 11 – 13, 36 – 38, 41 and 42 under 35 U.S.C. § 103(b) as being obvious over Russell in view of U.S. Patent No. 5,796,259 to Dickmader.

Claim 11 is directed to an arc fault protection device, protective of a branch circuit portion of a power line electrical distribution system and connected to a load. The device includes a first sensor for detecting current fluctuations in at least one current characteristic of load current. The device also includes a second sensor for detecting voltage fluctuations in at least one voltage characteristic of a line voltage. A discriminator compares the polarities of the voltage fluctuations and the current fluctuations. The comparison indicates whether an arc fault or arc mimicking noise is located in the branch circuit portion or located in a remainder of the electrical distribution system based on the comparison of the polarities.

Claim 41 is directed to an arc fault protection device, protective of a branch circuit portion of an electrical distribution system and connected to a load. The device includes means for detecting current fluctuations in at least one current characteristic of load Current. The device further includes means for detecting voltage fluctuations in at least one voltage characteristic of a line voltage. Means are included for comparing the polarities of the voltage fluctuations and the current fluctuations. The comparison indicates whether an arc fault or arc mimicking noise is located in the branch circuit portion or located in a remainder of the electrical distribution system based on the comparison of the polarities.

Claim 42 is directed to a method for protecting a branch circuit portion of an electrical distribution system from an arc fault, the branch circuit portion being connected to a load. The method includes: detecting current fluctuations in at least one current characteristic of load current; detecting voltage fluctuations in at least one voltage characteristic of a line voltage; and comparing the polarities of the voltage fluctuations and the current fluctuations. The comparison indicates whether an arc fault or arc mimicking noise is located in the branch circuit portion or located in a remainder of the electrical distribution system based on the comparison of the polarities.

Dickmader discloses a method and apparatus that includes a voltage sampler for generating samples of the line voltage and a current sampler that generates samples of the line current. A first comparator compares the current samples from the previous power cycle to the current samples from the present cycle and determines the sign of the difference between the current samples. A second comparator compares the sign of the voltage from the previous

cycle to the current sign determined by the first comparator and provides an indication of fault direction in relation to such comparison. The apparatus also includes a fault inception determiner, for providing a fault inception indication in relation to the voltage samples from the previous and present cycles. The fault inception determiner is a comparator which compares the voltage samples from the previous cycle to the voltage samples from the present cycle and determines the sign of the difference between the samples. A synchronizer, such as a phase locked loop, must be used to synchronize the generation of the voltage and current samples at approximately the same points during each system cycle.

*B.1. The Prior art references do not teach or suggest all of the claim limitations*

The Applicants respectfully point out that the Examiner has failed to make a prima facie case of obviousness because the Examiner does not point out where the references teach or suggest each and every element set forth in claims 11, 41, and 42.

The Examiner states that Russell (col. 4, lines 1 – 5) teaches a first sensor for detecting current fluctuations in a load current and second sensor that detects voltage fluctuations in a line current. However, the cited text only refers to a single transducer 30 that provides a “dual load current” and a phase voltage signal. See col. 4, lines 3 – 4. The Examiner fails to point out where either Russell or Dickmander teach or suggest a discriminator circuit as recited in the claims 11, 41, and 42. The Examiner does not show where Dickmander compares line voltage to load current as the Examiner asserts. The Examiner does not show where Dickmander discloses a sensor for detecting either line voltage fluctuations or load current fluctuations, or a discriminator that compares the polarities of line voltage fluctuations with load current fluctuations. Dickmander does not teach voltage fluctuation, only the existence of an AC voltage having a positive polarity and a negative polarity. Thus, the Examiner has not pointed out where Dickmander discloses the claim elements that are clearly not shown in Russell. Accordingly, Dickmander does not make up for Russell’s deficiencies. Further, as noted in a previous response, the Examiner erroneously asserts that Dickmander discloses the detection of arc faults. However, an electronic search of the document reveals that the term “arc fault” is not mentioned a single time anywhere in Dickmander.

B.2. There is No Suggestion to Combine the Prior Art References

Again, if proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). In this case, Russell is directed to an analyzer disposed in a power utility substation. The analyzer monitors for arc burst patterns. Dickmander is directed to monitoring a silicon transfer switch that is used to provide uninterrupted power to a building, plant or military base. Dickmander is not directed to arc faults. Accordingly, Dickmander could not be used in Russell because it does not detect arc faults. As noted above, an electronic search of the document reveals that the term “arc fault” is not mentioned a single time anywhere in Dickmander.

The Examiner has not made a prima facie case of obviousness for the aforementioned reasons. Dependent claims 12 – 13, 36 – 38 are allowable in their own right. Accordingly, claims 11 – 13, 36 – 38, 41, and 42 are patentable under 35 U.S.C. § 103(a). The Applicants respectfully request that the rejection of claims 11 – 13, 36 – 38, 41, and 42 under 35 U.S.C. § 103(a) be withdrawn.

C. The Examiner has rejected claims 2 and 6 under 35 U.S.C. § 103(b) as being obvious over Russell in view of Heller, and further in view of U.S. Patent No. 5,439,509 to Blades. Claims 2 and 6 depend from claim 1. As noted above, neither Russell nor Heller, whether taken alone or in combination teach or suggest all of the limitations recited in claim 1. The Examiner has not shown the Blades includes the elements missing from the base references. Accordingly, claim 2 and claim 6 are allowable by virtue of their dependency from claim 1. Further, Russell, Heller, and Blades are not combinable. The Applicants previously pointed out that Heller could not be combined with Russell because it would make Russell unsatisfactory for its intended purpose. The same rationale applies to Blades. Russell discloses a computerized analyzer disposed in a utility substation. Blades discloses an arc fault detector used by a repairman to diagnose intermittent arc faults in a residential setting. See col. 21, lines 60 – 66, Figures 10 – 12.



Accordingly, claims 2 and 6 are patentable under 35 U.S.C. § 103(a). The Applicants respectfully request that the rejection of claims 2 and 6 under 35 U.S.C. § 103(a) be withdrawn.

D. The Examiner has rejected claims 8 – 10 under 35 U.S.C. § 103(b) as being obvious over Russell in view of Heller, and further in view of U.S. Patent No. 4,922,368 to Johns. Claims 8 – 10 depend from claim 1. As noted above, neither Russell nor Heller, whether taken alone or in combination teach or suggest all of the limitations recited in claim 1. The Examiner has not shown the Johns includes the elements missing from the base references. Accordingly, claim 8 – 10 are allowable by virtue of their dependency from claim 1. Further, Russell, Heller, and Johns are not combinable. The Applicants previously pointed out that Heller could not be combined with Russell because it would make Russell unsatisfactory for its intended purpose. The same rationale applies to Johns. Russell discloses a computerized analyzer disposed in a utility substation. Johns discloses a discriminator circuit for use in a circuit breaker. See col. 3, lines 3 - 6.

Accordingly, claims 8 – 10 are patentable under 35 U.S.C. § 103(a). The Applicants respectfully request that the rejection of claims 8 – 10 under 35 U.S.C. § 103(a) be withdrawn.

E. The Examiner has rejected claims 24, 25, 33, 43, and 45 under 35 U.S.C. § 103(b) as being obvious over Russell in view of Dickmader and further in view of U.S. Patent No. 5,434,509 to Blades. As noted above, neither Russell nor Dickmader, whether taken alone or in combination, disclose every element of independent claims 11 and 42. The Examiner does not provide any evidence that Blades remedies the deficiencies of these references. Accordingly, claims 24, 25, 33, 43, and 45 are at least patentable by virtue of their dependency from claims 11 and 42. As noted above, Russell and Dickmader are not combinable under 35 U.S.C. § 103(b). Blades is also not combinable because Russell discloses a computerized analyzer disposed in a utility substation, whereas Blades discloses an arc fault detector used by a repairman to diagnose intermittent arc faults in a residential setting. See Figures 10 – 12. Blades would make Russell unsatisfactory for its intended purpose.

Accordingly, claims 24, 25, 33, 43, and 45 are patentable under 35 U.S.C. § 103(a). The Applicants respectfully request that the rejection of claims 24, 25, 33, 43, and 45 under 35 U.S.C. § 103(a) be withdrawn.

F. Examiner has rejected claims 31, 32, 34 and 35 under 35 U.S.C. § 103(b) as being obvious over Russell in view of U.S. Patent No. 5,796,259 to Dickmander, and further in view of Johns. As noted above, neither Russell nor Dickmander, whether taken alone or in combination teach or suggest all of the limitations recited in claim 11. The Examiner has not shown the Johns includes the elements missing from the base references. Accordingly, claim 31, 32, 34 and 35 are allowable by virtue of their dependency from claim 11. Further, Russell, Dickmander, and Johns are not combinable. The Applicants previously pointed out that Dickmander could not be combined with Russell because it would make Russell unsatisfactory for its intended purpose. The same rationale applies to Johns. Russell discloses a computerized analyzer disposed in a utility substation. Johns discloses a discriminator circuit for use in a circuit breaker. See col. 3, lines 3 - 6.

Accordingly, claims 31, 32, 34 and 35 patentable under 35 U.S.C. § 103(a). The Applicants respectfully request that the rejection of claims 31, 32, 34 and 35 under 35 U.S.C. § 103(a) be withdrawn.

G. Examiner has rejected claim 14 under 35 U.S.C. § 103(b) as being obvious over Russell in view of U.S. Patent No. 5,796,259 to Dickmander and further in view of Nimmersjo. First, none of the cited references pertain to an arc fault detector as recited in the instant application. Instead, all of the references pertain to power line monitoring implementations. Again, neither Russell nor Dickmander, whether taken alone or in combination teach or suggest all of the limitations recited in claim 11. The Examiner has not shown that the Nimmersjo reference includes the elements missing from the base references. Accordingly, claim 14 is allowable by virtue of its dependency from claim 11.

Accordingly, claim 14 is patentable under 35 U.S.C. § 103(a). The Applicants respectfully request that the rejection of claim 14 under 35 U.S.C. § 103(a) be withdrawn.

**5. Conclusion**

Based upon the remarks and papers of record, Applicant believes the pending claims of the above-captioned application are in allowable form and patentable over the prior art of record. Applicant respectfully requests reconsideration of the pending claims 1 – 55 and a prompt Notice of Allowance thereon.

Applicant believes that no extension of time is necessary to make this Response timely. Should Applicant be in error, Applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as necessary to make this Response timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 50-1546.

Please direct any questions or comments to Daniel P. Malley at (607) 330-4010.

Respectfully submitted,

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